

no longer a matter of theory or microscopic investigation. When it becomes fractured it produces callus just as does a living bone. That periosteum is not an essential element in the graft is proved by the fact that in many cases a naked bone graft heals in position and becomes united to its bed. The best example of this is in the living tibial peg driven into the neck of a fractured femur. Nevertheless the preservation of the periosteum is very desirable in all cases except those where the graft is entirely intramedullary. The role of the periosteum is remarkably demonstrated by the comparison of three types of operation: (1) Where the naked graft is used, increase in thickness of the graft, even after long survival, is very slow. Whenever sepsis supervenes, the graft becomes entirely exfoliated without depositing any new bone. (2) Where periosteal flaps with a thin layer of bone are turned down to bridge the gap, no new bone is deposited, and failure results. This shows that periosteum, even when retaining its attachment, will not deposit new bone in an adult. (3) Where a graft covered on one surface by its own periosteum is used, its behavior is different from either of the above groups. Increase in thickness occurs in all cases within a few months. In those cases in which secondary sepsis supervenes, there is an abundant deposit of new bone between the periosteum and the graft. The solid portion of the graft may be exfoliated, but a mass of new bone is left behind of larger bulk than that originally used. From these facts it may be inferred that the osteoblasts necessary for new bone formation are contained in the dense bone, but that the protecting and vascularizing matrix of the periosteum is necessary for their activity. The success of all plastic surgery depends largely upon accurate suturing. Bone being a tissue of slow growth and slow repair, requires more firm and lasting sutures than the soft tissues. There are three methods used for the fixation of a graft: (1) Suture by ordinary absorbable sutures; (2) fitting by accurate joinery; (3) fixation by means of metal screws, pins, wires, or plates. The series reported by Groves, contains 34 cases of autogenous bone grafting. Of these, 10 (29.4 per cent.) have been failures, 5 (14.7 per cent.) have been eventual successes in producing bone union after extrusion of the graft, and 19 (55.8 per cent.) have been complete successes.

Changes in Growing Bone after Injury to Epiphyseal Cartilage Plate.
—HAAS (*Jour. Orthop. Surg.*, 1919, i, 67) says that the longitudinal growth of bone is maintained by changes taking place in the epiphyseal cartilage plate. As long as this highly differentiated cartilage mass persists there is opportunity for further increase in length, but with its ossification there is loss of that property. As a working principle it is necessary to know the exact portion of the epiphyseal cartilage plate that is most essential to bone growth. The greatest growth activity is localized in the cartilage columns of the epiphyseal cartilage plate and after the destruction of this portion of the plate, length growth practically terminates. The metaphyseal cartilage serves chiefly as a medium for or is the site where the newly formed cartilage is transformed into osseous tissue. For the proper functioning of the epiphyseal cartilage plate it is essential that it shall receive an adequate blood supply. If all the bloodvessels entering the bone in this region of the plate are destroyed, a very marked loss of growth takes place. This

loss of growth is much greater than when the nutrient artery is destroyed. Closely associated with the bloodvessels is the character of the constituents of the blood. If there is lacking some necessary chemical elements a loss of growth is likely to take place. Thus in certain diseases and in abnormalities of the endocrine system disturbances in growth frequently occur. Trauma is the most frequent cause of disturbances in growth of bones. It must be remembered that an injury in the region of the epiphyseal cartilage plate may be confined entirely to the superficial tissues, to the deeper tissues containing the vascular supply to the epiphyseal cartilage plate, to the epiphyseal cartilage plate itself or may be a combined injury of more than one of these structures. Upon the severity of the destructive process to these vital growing parts depends the resulting disturbances in growth.

Study of Buried Bone.—COWAN and ELY (*Jour. Orthop. Surg.*, 1919, i, 101) made their study upon a series of knee-joint resections in the dog. A patella or the fragment of another bone, embedded fresh in the muscles of the animal from which it was removed, has a tendency to disappear, but does not disappear at least for a long time. In none of their cases had it disappeared completely. Its structure becomes less dense. The bone tissue itself may be replaced by fibrous tissue, especially at or near the circumference, or it may be absorbed. Absorption is the rule in the interior. Occasionally typical rarefying osteitis by osteoclasts is seen. More frequently the process seems to be one of simple absorption—"halisteresis." The method of absorption is often difficult to determine, for about many of the trabeculae there are no giant cells, no leukocytic infiltration, and no increased vascularity of the marrow. Many of the cells disappear early from the bone. Others stain well after the expiration of a long time. Death of bone is the rule. A patella, with a complete investment of bone and cartilage, does not resist absorption better than a bone fragment whose marrow is exposed to the surrounding tissue. A blood supply is established in the marrow of the buried bone. The marrow has a tendency to become fatty and fibrous, though lymphoid paths may persist. It is engorged in animals who have died with an acute infectious disease, as is the marrow of normal bone in such circumstances. In other words, it is functioning as marrow. Cartilage becomes eroded at its surface, and is replaced by fibrous tissue. Sometimes it disappears completely in areas. Its cells often stain well after a long time. Sometimes they die after a shorter time. The buttress underneath the cartilage almost always disappears early. Roughly, the changes in bone and cartilage are the same as those seen in atrophic, or proliferating arthritis.

Abduction Treatment of Fracture of the Neck of the Femur.—WHITMAN (*Surg., Gynec. and Obst.*, 1918, xxvii, 578) says that non-union occurs in childhood under the same circumstances as in adult life, although there can be no question of the capacity of the tissues for repair. Repair after non-union is the rule when at open operation the fragments are freshened and adjusted, indicating that fixation in apposition is the first essential of success. Experience in bone grafting proves that union is possible under far less favorable conditions, as regards the blood supply, than in fracture of the neck of the femur. The obstacles